NOTES

1. Papers selected for inclusion in General Sessions will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

2. Papers selected for inclusion in Specialized Sessions will be available at the Conference in only one of the above official languages.

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C.4.1.

USE OF RADIATION AND CHEMICAL MUTAGENS IN THE PRODUCTION OF MUTATIONS IN A CROP OF RELEVANT INTEREST TO MEDITERRANEAN AGRICULTURE, DURUM WHEAT.

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SUMMARY

Durum wheat, the raw material for macaroni production, is essentially a crop of semi-arid climates; it is grown mostly in Southern Europe, North America, North Africa, Near East, URSS and Argentina. Yield of durum is substantially less than that of bread wheat. Production of durum wheat in the Mediterranean countries, for which data are available (Table 1), covers nearly 80 per cent of world production. In view of the economic importance of durum wheat in Italy, and in the Mediterranean area generally, a program on experimental mutagenesis in this crop was started in 1956, for both fundamental genetic research and breeding of improved lines. So far, mutation induction by seed treatment has been carried out in the varieties Cappelli, Aziziah, Russello, Grifoni and Garigliano; the mutagens used were X-rays, thermal neutrons, fast neutrons, ethyl methane sulphonate (EMS) and diethyl sulphate (DS).

Scoring of chlorophyll mutations in the M_2 generation (progeny of plants grown from treated seeds) took place in the greenhouse; a total number of 20.200 spikes, belonging to 5,902 M_1 plants, were analyzed. The following types of mutations were found: albina, xantha, xanthalba, chloroalbina, viridoalbina, striata, tigrina, chlorina, viridis. The relative frequencies of of the various types of chlorophyll mutations induced by EMS and DS are significantly different from those induced by radiations. Within the three types of radiations used, differences in mutation

spectra are not significant or are at the limit of significance. Figure I shows the frequencies of chlorophyll mutations per spike progeny induced in durum wheat by the different mutagenic treatments applied. A characteristic common to the three types of ionizing radiations used is that high mutation rates are induced by doses producing a strong reduction, generally from 50 to 80%, in the mean number of M_2 seedlings per spike (in practice, average spike fertility). On the contrary, with EMS and DS, the highest mutation frequencies are observed in treatments producing only a 33 to 42% reduction in the mean number of M_2 seedlings per spike. This contrasting behaviour of radiations on one side and chemicals on the other is clearly shown in figure II. Another conspicuous difference in action between radiations and chemical mutagens lies in the size of mutated sectors in M_1 spikes, as revealed by M_2 segregation ratios. Taking into account all radiation experiments, the mean segregation ratio was 15,9% (range 11.6-19.7%). In contrast to radiations, the segregation ratios found in chemically treated material ranged from 3.9 to 14.9% (mean 11.8%).

In M_2 and following generations in durum wheat, viable mutations affecting several physiological and prominent phenotypic characters have been isolated. At present, a total of 268 mutations, each of which derived from a single M_1 plant, is available at our Laboratory. These mutations involve either single or several characters (complex phenotypes) manifesting themselves in the various stages of the vegetative cycle (Table 2). The whole of the mutations available is at present being made the object of genetic and cytogentic studies. Since a large portion of the induced mutations in durum wheat are phenotypically similar to the naturally occurring ones, special attention is deserved to the inheritance of the induced changes. 12 different types of viable mutations analyzed so far have all shown a monogenic type of inheritance (recessive). Analysis at meiosis of mutants and of their F_1 crosses to the mother line has demonstrated the occurrence, in 25 out of 50 mutants studied, of reciprocal translocations.

Considering the requirements for the improvement of Italian varieties of durum wheat, several induced mutations (short straw, solid stem, lodging resistance, increased spike and spikelet fertility) seem to be very promising. In order to evaluate their agronomic properties, some of them have been included in field trials carried out also by Profs: U. De Cillis, Institute of Cereal Genetics, Rome; A. Ciccarone, Institute of Plant Pathology, Bari; L. Cavazza, Institute of Agronomy, Bari and R. Barbieri, Institute of Agronomy, Sassari, on behalf of the Italian National Research Council. These experiments have been going on since 1960 in 4 Stations in South and Central Italy and Sardinia, namely: Bari, Foggia, Roma and Cagliari. Data on the performance of some of the mutants are shown in Figure III. To verify if some mutants obtained had a higher lodging resistance in high nitrogen soil content, an experiment with 8 short straw mutants was carried out. The behaviour of the control and of 3 of those mutants at different levels of nitrogen is shown in Fig. IV.

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